What is claimed is:

1. A wavelength-multiplexed narrow-bandwidth optical transmitter, comprising:

a plurality of first optical transmission lines that transmit a plurality of light signals, each of which has a center wavelength different from the other;

a first optical wavelength multiplexer to which the plurality of first optical transmission lines are optically connected;

an optical filter that has predetermined periodic transmittivity for a wavelength; and

a second optical transmission line for transmitting emitted light, which is output from the optical filter;

wherein:

after the plurality of light signals, each of which has a center wavelength different from the other, are wavelength-multiplexed using the first optical wavelength multiplexer, the plurality of wavelength-multiplexed light signals are transmitted through the optical filter so that, corresponding to each of the plurality of light signals, each of which has a center wavelength different from the other, each light signal, a bandwidth of which has been narrowed as compared with each light signal before the light signal is transmitted through the optical filter, is obtained.

2. A wavelength-multiplexed vestigial-side-band optical transmitter, comprising:

a plurality of first optical transmission lines that transmit a plurality of light signals, each of which has a center wavelength different from the other;

a first optical wavelength multiplexer to which the plurality of first optical transmission lines are optically connected;

an optical filter that has predetermined periodic transmittivity for a wavelength; and

a second optical transmission line for transmitting emitted light, which is output from the optical filter;

wherein:

after the plurality of light signals, each of which has a center wavelength different from the other, are wavelength-multiplexed using the first optical wavelength multiplexer, the plurality of wavelength-multiplexed light signals are transmitted through the optical filter, and corresponding to each of the plurality of light signals, each of which has a center wavelength different from the other, only a light signal corresponding to a single side band is transmitted from among components of each light signal before the light signal is transmitted through the optical filter, whereby each of the light signals that have been transmitted is used as a vestigial-side-band signal.

3. A wavelength-multiplexed narrow-bandwidth optical

transmitter according to Claim 1, comprising:

a plurality of first optical transmission lines that transmit a plurality of light signals, each of which has a center wavelength different from the other;

a plurality of first optical wavelength multiplexers to which the plurality of first optical transmission lines are optically connected;

a plurality of optical filters, each of which is placed corresponding to each of the plurality of first optical wavelength multiplexers, each filter having predetermined periodic transmittivity for a wavelength;

a second optical wavelength multiplexer that wavelength-multiplexes a plurality of light signals, which have been transmitted through the plurality of optical filters; and

a second optical transmission line for transmitting emitted light, which is output from the second optical wavelength multiplexer;

wherein:

after the plurality of light signals, each of which has a center wavelength different from the other, are wavelength-multiplexed using the first optical wavelength multiplexer, the plurality of wavelength-multiplexed light signals are transmitted through the optical filter so that, corresponding to each of the plurality of light signals, each of which has a center wavelength different from the

other, each light signal, a bandwidth of which has been narrowed as compared with each light signal before the light signal is transmitted through the optical filter, is obtained; and

a predetermined set of the first optical transmission line, the first optical wavelength multiplexer, and the optical filter outputs N pairs of wavelength-multiplexed signals, for which wavelength interleave has been performed at Nth wavelength intervals (N is an integer that is greater than or equal to 2) respectively, and said N pairs of wavelength-multiplexed light, which have been output, are wavelength-multiplexed by the second optical wavelength multiplexer without controlling a polarization state one another.

4. A wavelength-multiplexed vestigial-side-band optical transmitter according to Claim 2, comprising:

a plurality of first optical transmission lines that transmit a plurality of light signals, each of which has a center wavelength different from the other;

a plurality of first optical wavelength multiplexers to which the plurality of first optical transmission lines are optically connected;

a plurality of optical filters, each of which is placed corresponding to each of the plurality of first optical wavelength multiplexers, each filter having predetermined periodic transmittivity for a wavelength;

a second optical wavelength multiplexer that wavelength-multiplexes a plurality of light signals, which have been transmitted through the plurality of optical filters; and

a second optical transmission line for transmitting emitted light, which is output from the second optical wavelength multiplexer;

wherein:

after the plurality of light signals, each of which has a center wavelength different from the other, are wavelength-multiplexed using the first optical wavelength multiplexer, the plurality of wavelength-multiplexed light signals are transmitted through the optical filter, and corresponding to each of the plurality of light signals, each of which has a center wavelength different from the other, only a light signal corresponding to a single side band is transmitted from among components of each light signal before the light signal is transmitted through the optical filter, whereby each of the light signals that have been transmitted is used as a vestigial-side-band signal; and

a predetermined set of the first optical transmission line, the first optical wavelength multiplexer, and the optical filter outputs N pairs of wavelength-multiplexed signals, for which wavelength interleave has been performed at Nth wavelength intervals (N is an integer

that is greater than or equal to 2) respectively, and said N pairs of wavelength-multiplexed light, which have been output, are wavelength-multiplexed by the second optical wavelength multiplexer without controlling a polarization state one another.

5. A wavelength-multiplexed narrow-bandwidth optical transmitter according to Claim 3, wherein:

an optical wavelength multiplexer, transmittivity of which has wavelength dependency, is used as the second optical wavelength multiplexer;

in the second optical wavelength multiplexer, a transmission bandwidth for each light signal having a different wavelength is made narrower than a spectrum width of a light signal; and

a plurality of transmission peak wavelengths of the second optical wavelength multiplexer are adjusted so as to become substantially equivalent to center wavelengths of light signals incident on the second optical wavelength multiplexer respectively.

6. A wavelength-multiplexed vestigial-side-band optical transmitter according to Claim 4, wherein:

an optical wavelength multiplexer, transmittivity of which has wavelength dependency, is used as the second optical wavelength multiplexer;

in the second optical wavelength multiplexer, a transmission bandwidth for each light signal having a

different wavelength is made narrower than a spectrum width of a light signal; and

a plurality of transmission peak wavelengths of the second optical wavelength multiplexer are adjusted so as to become substantially equivalent to single side band portions of the light signals incident on the second optical wavelength multiplexer respectively.

7. A wavelength-multiplexed narrow-bandwidth optical transmitter according to Claim 3, wherein:

an optical wavelength multiplexer, transmittivity of which has wavelength dependency, is used as the first optical wavelength multiplexer;

in the first optical wavelength multiplexer, a transmission bandwidth for each light signal having a different wavelength is made narrower than a spectrum width of a light signal; and

a plurality of transmission peak wavelengths of the first optical wavelength multiplexer are adjusted so as to become equivalent to center wavelengths of light signals incident on the first optical wavelength multiplexer respectively.

8. A wavelength-multiplexed vestigial-side-band optical transmitter according to Claim 4, wherein:

an optical wavelength multiplexer, transmittivity of which has wavelength dependency, is used as the first optical wavelength multiplexer;

in the first optical wavelength multiplexer, a transmission bandwidth for each light signal having a different wavelength is made narrower than a spectrum width of a light signal; and

a plurality of transmission peak wavelengths of the first optical wavelength multiplexer are adjusted so as to become substantially equivalent to single side band portions of the light signals incident on the first optical wavelength multiplexer respectively.

9. A wavelength-multiplexed vestigial-side-band optical transmitter, comprising:

a plurality of optical transmission lines; and

at least one optical filter, which is optically connected to each of the plurality of optical transmission lines, a transmission bandwidth of said optical filter being narrower than a spectrum width of a signal that propagates through the optical transmission line;

wherein:

light signals are divided to pass the light signals through the plurality of optical transmission lines;

a peak wavelength of transmittivity of the optical filter corresponding to each of the optical transmission lines is set so that said peak wavelength is slightly different from the other peak wavelengths;

one light signal from among light signals passing through the plurality of optical transmission lines is used

to transmit an information signal as an optical vestigial-side-band signal; and

a wavelength of the light signal or a transmission wavelength of the optical filter is controlled so that intensity of the light signals, each of which has been transmitted through each of the optical transmission lines, becomes equal or shows a constant ratio.

10. A wavelength-multiplexed vestigial-side-band optical transmitter according to Claim 2, comprising:

a first optical demultiplexer placed in the middle of an optical path, which leads to the first optical filter via the first wavelength multiplexer;

a second optical filter on which light divided by the first optical demultiplexer falls, said second optical filter having transmittivity, a transmission bandwidth of which is narrower than a spectrum width of the light signal;

a first optical photoreceiver for receiving transmitted light from the second optical filter;

a second optical demultiplexer for dividing light, which has been transmitted through the first optical filter, into a plurality of optical paths;

a second optical photoreceiver for receiving at least one of the divided light; and

a feedback signal circuit that operates in response to signals from the first and the second optical

photoreceiver;

wherein:

peak wavelengths of transmittivities of the first and second optical filters are set so that each of the peak wavelengths slightly differs from the other;

at least one of the light signals divided by the second optical demultiplexer is used to transmit an information signal as an optical vestigial-side-band signal; and

with respect to each light signal having a different wavelength, a wavelength of the light signal or a transmission wavelength of the optical filter is controlled so that intensity of light signals, which have been transmitted through the first optical filter and the second optical filter, becomes equal or shows a constant ratio.

11. A wavelength-multiplexed vestigial-side-band optical transmitter according to Claim 4, comprising:

a first optical demultiplexer placed in the middle of an optical path, which leads to the first optical filter via the first wavelength multiplexer;

a second optical filter on which light divided by the first optical demultiplexer falls, said second optical filter having transmittivity, a transmission bandwidth of which is narrower than a spectrum width of the light signal;

a first optical photoreceiver for receiving

transmitted light from the second optical filter;

a second optical demultiplexer for dividing light, which has been transmitted through the first optical filter, into a plurality of optical paths;

a second optical photoreceiver for receiving at least one of the divided light; and

a feedback signal circuit that operates in response to signals from the first and the second optical photoreceiver;

wherein:

peak wavelengths of transmittivities of the first and second optical filters are set so that each of the peak wavelengths slightly differs from the other;

at least one of the light signals divided by the second optical demultiplexer is used to transmit an information signal as an optical vestigial-side-band signal; and

with respect to each light signal having a different wavelength, a wavelength of the light signal or a transmission wavelength of the optical filter is controlled so that intensity of light signals, which have been transmitted through the first optical filter and the second optical filter, becomes equal or shows a constant ratio.

12. A wavelength-multiplexed vestigial-side-band optical transmitter according to Claim 6, comprising:

a first optical demultiplexer placed in the middle

of an optical path, which leads to the first optical filter via the first wavelength multiplexer;

a second optical filter on which light divided by the first optical demultiplexer falls, said second optical filter having transmittivity, a transmission bandwidth of which is narrower than a spectrum width of the light signal;

a first optical photoreceiver for receiving transmitted light from the second optical filter;

a second optical demultiplexer for dividing light, which has been transmitted through the first optical filter, into a plurality of optical paths;

a second optical photoreceiver for receiving at least one of the divided light; and

a feedback signal circuit that operates in response to signals from the first and the second optical photoreceivers;

wherein:

peak wavelengths of transmittivities of the first and second optical filters are set so that each of the peak wavelengths slightly differs from the other;

at least one of the light signals divided by the second optical demultiplexer is used to transmit an information signal as an optical vestigial-side-band signal; and

with respect to each light signal having a different

wavelength, a wavelength of the light signal or a transmission wavelength of the optical filter is controlled so that intensity of light signals, which have been transmitted through the first optical filter and the second optical filter, becomes equal or shows a constant ratio.

13. A wavelength-multiplexed vestigial-side-band optical transmitter according to Claim 8, comprising:

a first optical demultiplexer placed in the middle of an optical path, which leads to the first optical filter via the first wavelength multiplexer;

a second optical filter on which light divided by the first optical demultiplexer falls, said second optical filter having transmittivity, a transmission bandwidth of which is narrower than a spectrum width of the light signal;

a first optical photoreceiver for receiving transmitted light from the second optical filter;

a second optical demultiplexer for dividing light, which has been transmitted through the first optical filter, into a plurality of optical paths;

a second optical photoreceiver for receiving at least one of the divided light; and

a feedback signal circuit that operates in response to signals from the first and the second optical photoreceivers;

wherein:

peak wavelengths of transmittivities of the first and second optical filters are set so that each of the peak wavelengths slightly differs from the other;

at least one of the light signals divided by the second optical demultiplexer is used to transmit an information signal as an optical vestigial-side-band signal; and

with respect to each light signal having a different wavelength, a wavelength of the light signal or a transmission wavelength of the optical filter is controlled so that intensity of light signals, which have been transmitted through the first optical filter and the second optical filter, becomes equal or shows a constant ratio.

14. A wavelength-multiplexed narrow-bandwidth optical transmitter according to Claim 1, wherein:

for an optical path passing through the first wavelength multiplexer and the optical filter, the first wavelength multiplexer serves as a first optical demultiplexer that can also be used for optical division;

a wavelength reference device, on which light divided by the first optical demultiplexer falls, is additionally provided, said wavelength reference device having periodic characteristics for a wavelength; and

relation between a wavelength period of transmittivity of the optical filter and a wavelength period of the wavelength reference device is set at an

integral multiple or a submultiple each other, or both of an integral multiple and a submultiple are used for the relation.

15. A wavelength-multiplexed vestigial-side-band optical transmitter according to Claim 2, wherein:

for an optical path passing through the first wavelength multiplexer and the optical filter, the first wavelength multiplexer serves as a first optical demultiplexer that can also be used for optical division;

a wavelength reference device, on which light divided by the first optical demultiplexer falls, is additionally provided, said wavelength reference device having periodic characteristics for a wavelength; and

relation between a wavelength period of transmittivity of the optical filter and a wavelength period of the wavelength reference device is set at an integral multiple or a submultiple each other, or both of an integral multiple and a submultiple are used for the relation.

16. A wavelength-multiplexed narrow-bandwidth optical transmitter according to Claim 14, further comprising:

a tunable light source, which can change an output light wavelength at least by a wavelength period of the optical filter or more.

17. A wavelength-multiplexed vestigial-side-band

optical transmitter according to Claim 15, further comprising:

a tunable light source, which can change an output light wavelength at least by a wavelength period of the optical filter or more.